Zeitschrift: Candollea : journal international de botanique systématique = international journal of systematic botany
Herausgeber: Conservatoire et Jardin botaniques de la Ville de Genève
Band: 43 (1988)
Heft: 2

Artikel: Chromosome numbers in Compositae from Pakistan
Autor: Khatoon, Surayya / Ali, S.I.
DOI: https://doi.org/10.5169/seals-879749

Chromosome numbers in Compositae from Pakistan

SURAYYA KHATOON
&
S. I. ALI

RÉSUMÉ

KHATOON, S. & S. I. ALI (1988). Nombres chromosomiques de Composées du Pakistan. *Candollea* 43: 455-465. En anglais, résumés français et anglais.

42 dénombrements chromosomiques de 36 membres des Composées sont rapportés pour le Pakistan. Des dénombrements pour 16 taxons sont rapportés pour la première fois, soit *Erigeron cyanactis* Rech. f. (*n* = 9), *E. leptocladus* Rech. f. (*n* = 9), *Heteropappus altaicus* var. *decrescens* Grierson (*n* = 9), *H. holohermaphroditus* Grierson (*n* = 9), H. sp. (*n* = 9), *Leontopodium jacotianum* Beauverd (*n* = 12, 14), *Hertia intermedia* (Boiss.) O. Ktze. (*n* = 10), *Senecio kraschaninnikovii* Schischkin (*n* = 9), *Anthemis rhodocentra* Iranshahr (*n* = 9), *Tanacetum gracile* Hook. f. & Thoms. (*n* = 9), *T. macropodum* Hemsl. & Lace (*n* = 9), *Cousinia stocksii* C. Winkl. (*n* = 12), *Zoegea purpurea* Fresen (*n* = 8), *Heteroderis stocksiana* Boiss. (2*n* = 6), *Scorzonera divaricata* Turcz. (*n* = 7) et *Sonchus wightianus* DC. (*n* = 9). Les dénombrements pour *Heteroderis stocksiana* est le premier pour ce genre. Les dénombrements pour 13 autres taxons sont nouveaux pour la flore du Pakistan.

ABSTRACT

KHATOON, S. & S. I. ALI (1988). Chromosome numbers in Compositae from Pakistan. *Candollea* 43: 455-465. In English, French and English abstracts.

42 chromosomal counts for 36 members of Compositae are reported from Pakistan. Counts for 16 taxa are reported for the first time, viz. *Erigeron cyanactis* Rech. f. (*n* = 9), *E. leptocladus* Rech. f. (*n* = 9), *Heteropappus altaicus* var. *decrescens* Grierson (*n* = 9), *H. holohermaphroditus* Grierson (*n* = 9), H. sp. (*n* = 9), *Leontopodium jacotianum* Beauverd (*n* = 12, 14), *Hertia intermedia* (Boiss.) O. Ktze. (*n* = 10), *Senecio kraschaninnikovii* Schischkin (*n* = 9), *Anthemis rhodocentra* Iranshahr (*n* = 9), *Tanacetum gracile* Hook. f. & Thoms. (*n* = 9), *T. macropodum* Hemsl. & Lace (*n* = 9), *Cousinia stocksii* C. Winkl. (*n* = 12), *Zoegea purpurea* Fresen (*n* = 8), *Heteroderis stocksiana* Boiss. (2*n* = 6), *Scorzonera divaricata* Turcz. (*n* = 7) and *Sonchus wightianus* DC. (*n* = 9). The count for *Heteroderis stocksiana* is the first report in this genus. Counts for 13 other taxa are new for the flora of Pakistan.

Introduction

Compositae is the largest family of flowering plants in the flora of Pakistan with about 604 native and 48 introduced species (ALI, 1978). Cytologically this family is fairly well known on world basis, as the chromosome numbers are available for about 40% of its species (SOLBRIG, 1977). But in Pakistan, only 36 species have hitherto been subjected to cytological studies (RAZAQ & al., unpublished), most of them being distributed in and around Karachi (lower Sind). The species found in other parts of the country are almost unknown cytologically. For the present study, the collections have been made mainly from the hilly regions of Sind, Baluchistan, N.W. Frontier Province, Gilgit and Baltistan. Chromosome numbers for another 36 species are reported here; many of these species are either endemic to Pakistan or have a limited distribution up to few neighbouring countries.

CODEN: CNDLAR
ISSN: 0373-2967
43(2) 455 (1988)

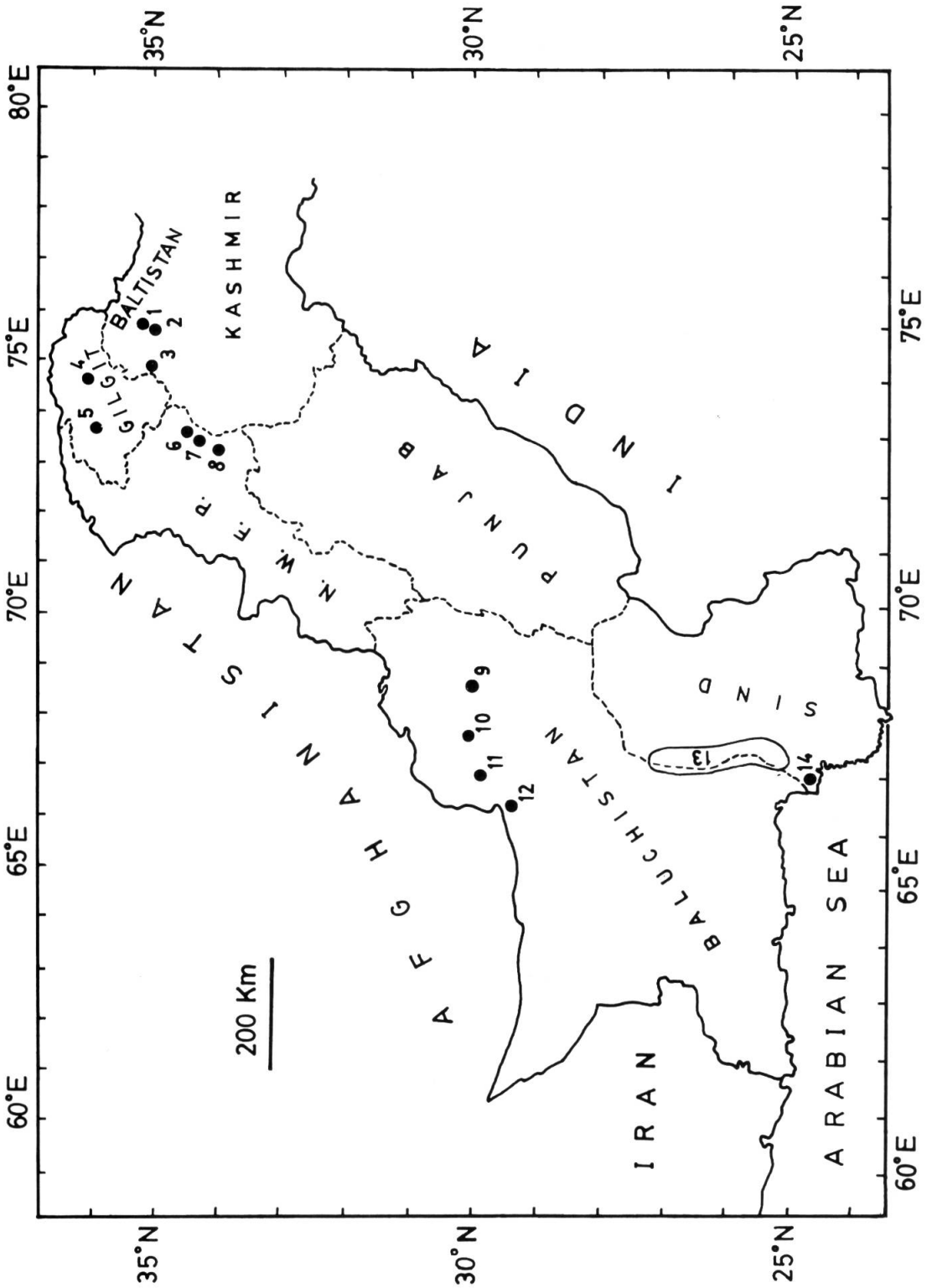

Fig. 1. — Map of Pakistan showing the localities.
1, Shigar (2200 m); **2**, Skardu (ca. 1829 m); **3**, Astore (2100 m); **4**, Hunza (ca. 4000 m); **5**, Gahkuch (2155 m); **6**, Kaghan (ca. 2100 m); **7**, Balakot (ca. 1800 m); **8**, Mansehra (ca. 1200 m); **9**, Loralai (1446 m); **10**, Ziarat (2445 m); **11**, Quetta (1702 m); **12**, Gurdgab (ca. 1900 m); **13**, Kerther Range (ca. 1372 m); **14**, Karachi (sea level).

Materials and methods

Young capitula were fixed in Carnoy's solution (alcohol-acetic acid, 3:1) and stored at ca. 5°C in the refrigerator. Slides were prepared in propionic-carmine by routine squash technique. In most cases, photographs were taken from the temporary mounts; the slides were later made permanent. All counts reported here were obtained from PMC-meiosis except in *Heteroderis stocksiana,* where the somatic count was obtained from the dividing cells of the young pappus. Voucher specimens are deposited in the Karachi University Herbarium (KUH).

Results

The results are summarised in Table 1. The counts which are new to science are marked with double asterisk, while those new to flora of Pakistan are marked by a single asterisk. The localities from where the specimens were collected are shown in Fig. 1. The voucher specimens were identified by the authors unless otherwise mentioned.

Discussion

The presently investigated species belong to six tribes of Compositae. Chromosome numbers of four species and one variety are determined in the tribe Astereae and all have $n = 9$ which is regarded as the basic number for the tribe by GRAU (1977). Two specimens of *Heteropappus holohermaphroditus* are analysed, the specimen from Baltistan *(Omer 362)* has much smaller chromosomes (Fig. 2D) as compared to that from Wali-Tangi (Quetta, Baluchistan, *Omer & Ghafoor 1785;* Fig. 2E). In external morphology also, both specimens are somewhat dissimilar, the former being closer to the original description of the species. However, we have left the latter specimen under *H. holohermaphroditus* until more information is available to enable us to decide its taxonomic position. In the same genus, the specimen *Omer & Ghafoor 1787* (collected from Wali-Tangi, Quetta, Baluchistan) is, in our opinion, a new species which would be described later.

In the tribe Inuleae, chromosome numbers of seven species in five genera have been determined. Base number $x = 7$ is found to be fairly prevalent in these species. According to MERXMÜLLER & al. (1977), 7 or its dysploid or euploid variants are base numbers in subtribe Gnaphaliinae to which *Gnaphalium* and *Leontopodium* belong. However, in *Leontopodium* gametic numbers 13 and 12 have so far been recorded. PODLECH & DIETERLÉ (1969) have suggested that these numbers are derived from the polyploid base of $x = 14$ through aneuploidy. MERXMÜLLER & al. (1977) also regard the species of *Leontopodium* as hypotetraploids based on $x = 7$. Our count of $n = 14$ is the first report of this number in the genus which strengthens this concept and provides a connection between *Leontopodium* and its related genera such as *Antennaria* and *Anaphalis* in which $n = 14$ or its multiples are prevalent. Unfortunately the voucher specimen is too young to be identified with certainty. Whether it is merely a cytotype of *L. jacotianum* or a distinct species, is not clear. However, the cytotypes are likely to occur in the species of *Leontopodium,* which, as stated by STEWART (1972) are probably apomictic. In the two species of *Pulicaria* studied by us, the gametic number is found to be 7 which is contrary to the previous reports in the case of *P. undulata* (Table 1). MERXMÜLLER & al. (1977) regard $x = 10$ & 9 (rarely 8) as the base numbers for the subtribe Inulinae (s.l.) to which *Pulicaria* belongs and $x = 7$ is doubtfully indicated as one of the base numbers. In *Pulicaria,* only one report of $2n = 14$ (*P. wightiana* Clarke by CHOPDE, 1965) was available upto that time. However, later studies revealed that $n = 7$ is not uncommon in this genus. BHANDARI & SINGHVI (in GOLDBLATT, 1981) have confirmed $n = 7$ in *P. wightiana* and determined $n = 7$ in *P. angustifolia* DC. RAZAQ & al. (unpublished) have determined $n = 7$ in *P. angustifolia* DC., *P. boissieri* Hook. f. and *P. hookeri* Jafri. It therefore seems obvious that $x = 7$ has independantly evolved in this genus through descending aneuploidy.

In Senecioneae, out of four, three species have $n = 10$ or 20. DARLINGTON & WYLIE (1955) and TURNER & LEWIS (1965) had suggested $x = 5$ to be the basic number for the tribe, but NORDENSTAM (1977) regards $x = 10$ as the basic number, $x = 5$ being derived from it, since $x =$

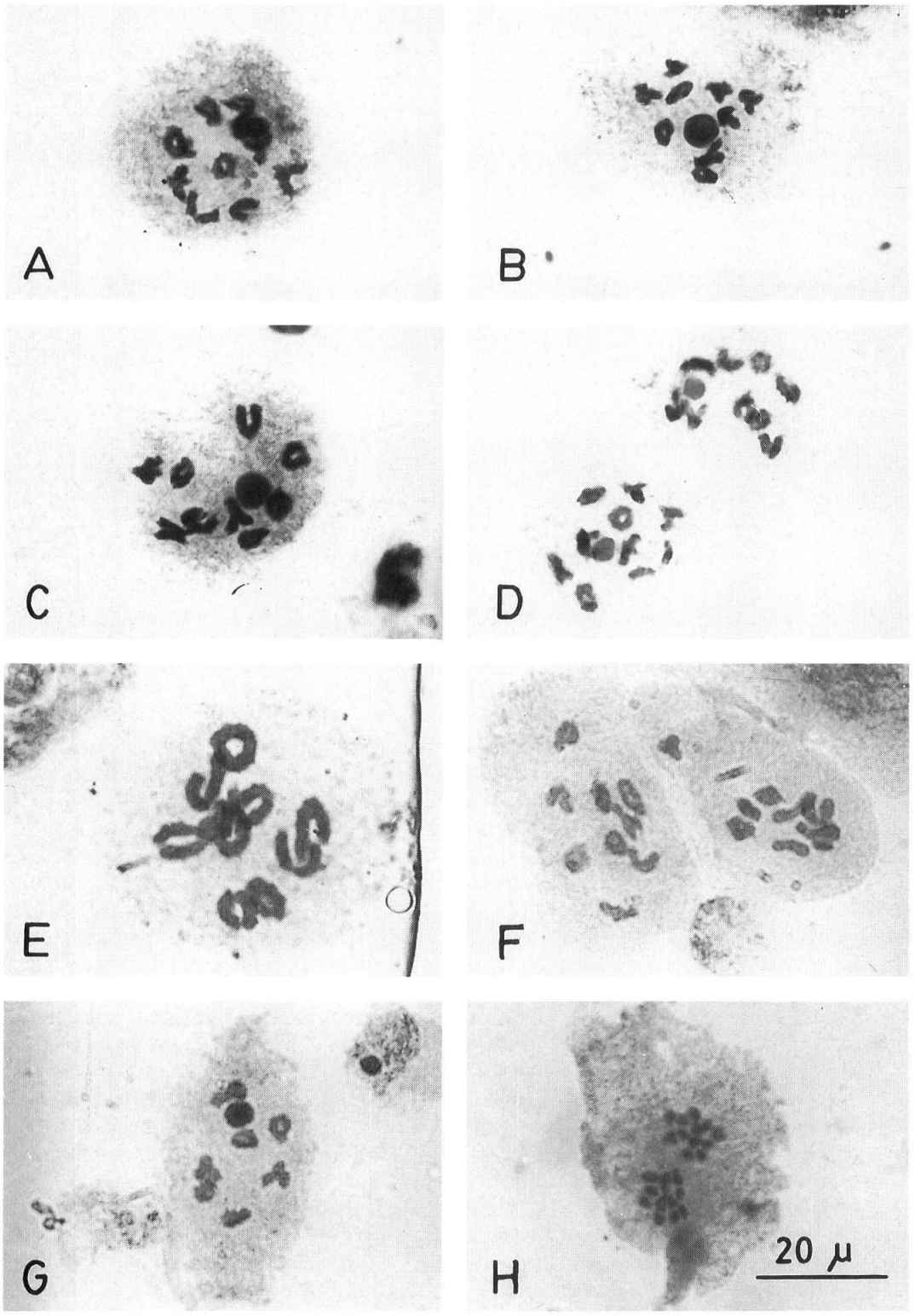

Fig. 2. — P. M. C. meiosis.
A, *Erigeron cyanactis* (diakinesis) *n* = 9 *(Omer 310);* **B,** *E. leptocladus* (diakinesis) *n* = 9 *(Omer 399);* **C,** *Heteropappus altaicus* var. *decrescens* (diakinesis) *n* = 9 *(Omer 294);* **D,** *H. holohermaphroditus* (diakinesis) *n* = 9 *(Omer 362);* **E,** same *(Omer & Ghafoor 1785);* **F,** *Heteropappus* sp. (diakinesis) *n* = 9 *(Omer & Ghafoor 1787);* **G,** *Gnaphalium luteo-album* (diakinesis) *n* = 7 *(Omer 1225);* **H,** *Leontopodium jacotianum* (metaphase-II) *n* = 12 *(Omer & al. 703).*

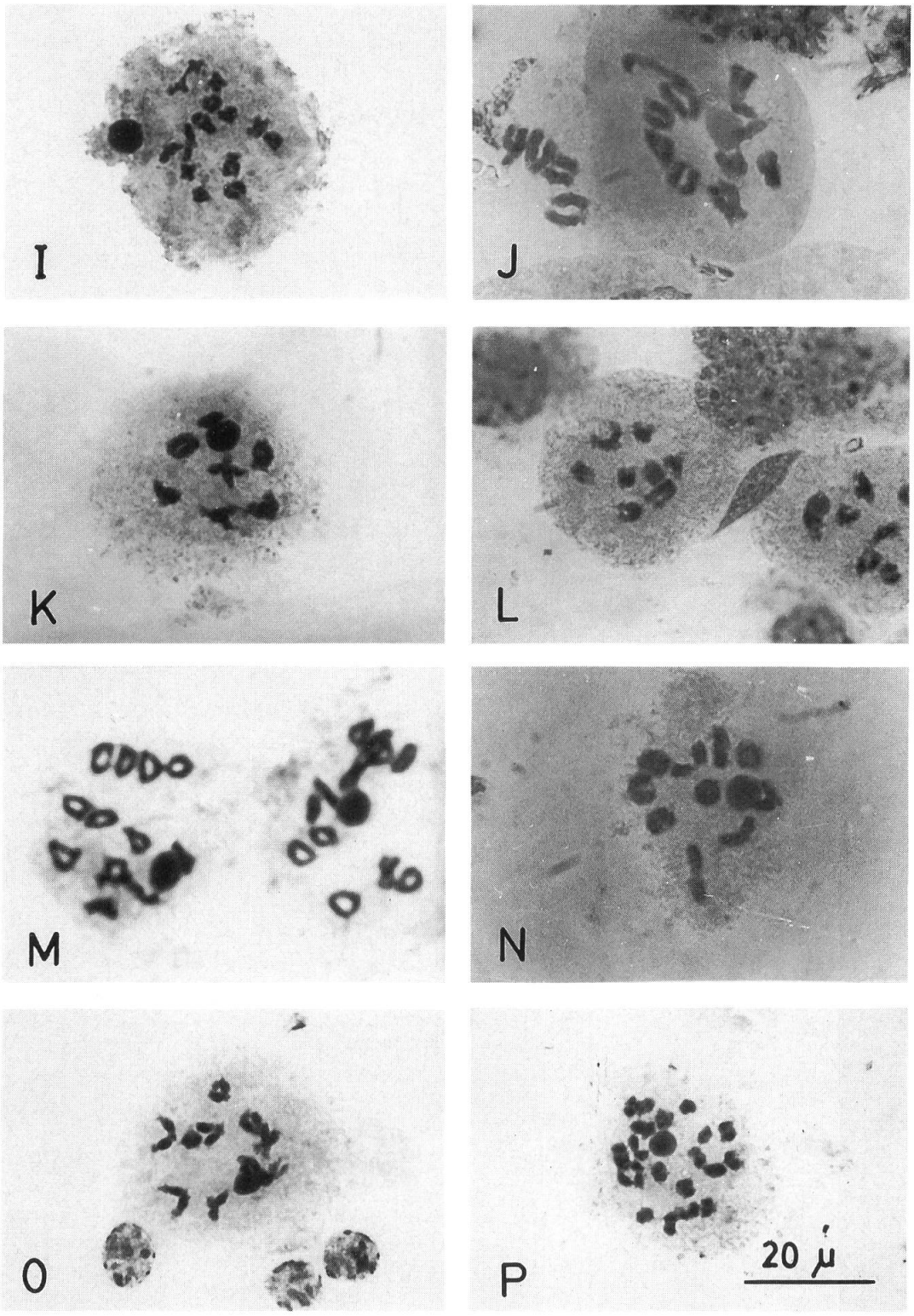

Fig. 2. — (contd.) **I,** *L.* cf. *jacotianum* (diakinesis) *n* = 14 *(Omer 353);* **J,** *Pegolettia senegalensis* (diakinesis) *n* = 10 *(Kh. 150);* **K,** *Pulicaria boissieri* (diakinesis) *n* = 7 *(Qaiser & al. 7221);* **L,** *P. undulata* (diakinesis) *n* = 7 *(Omer 1247);* **M,** *Coreopsis atkinsoniana* (diakinesis) *n* = 12 *(Omer 293);* **N,** *Hertia intermedia* (diakinesis) *n* = 10 *(Ghafoor & Yusuf 1358);* **O,** *Senecio desfontanei* (diakinesis) *n* = 10 *(Omer & al. 901);* **P,** *S. nudicaulis* (diakinesis) *n* = 20 *(Omer & al. 575).*

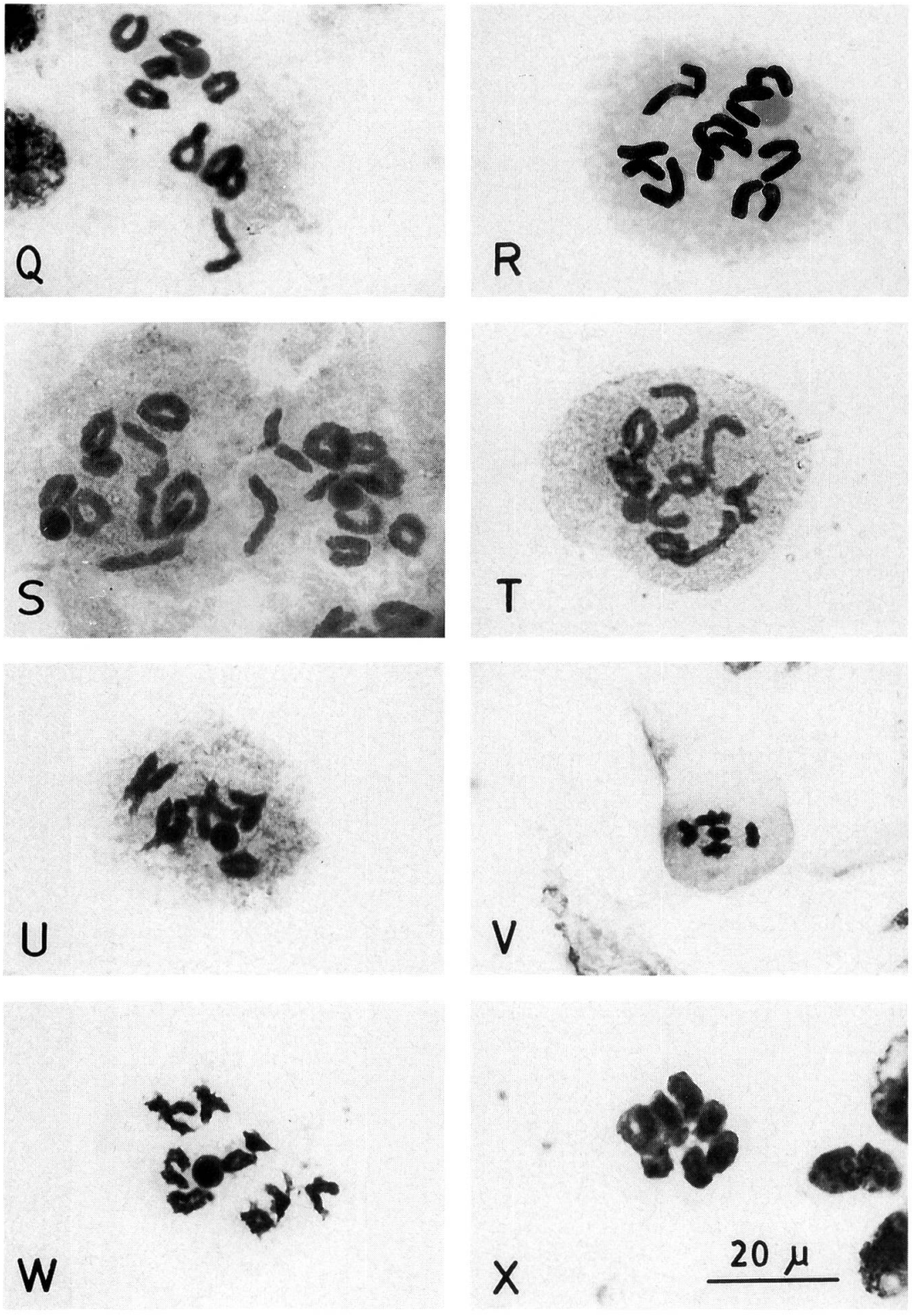

Fig. 2. — (contd.) **Q,** *Anthemis rhodocentra* (diakinesis) *n* = 9 *(Ghafoor & Yusuf 1405);* **R,** *Tanacetum gracile* (diakinesis) *n* = 9 *(Omer 426);* **S,** *T. macropodum* (diakinesis) *n* = 9 *(Ghafoor & Yusuf 1468);* **T,** *T.* cf. *macropodum* (diakinesis) *n* = 9 *(Omer & Ghafoor 1778);* **U,** *Crepis sancta* (diakinesis) *n* = 5 *(Omer 345);* **V,** same (metaphase-I) *n* = 5 *(Ghafoor & Yusuf 1239);* **W,** *Lactuca tatarica* (diakinesis) *n* = 9 *(Omer 401);* **X,** *Scorzonera divaricata* (metaphase-I) *n* = 7 *(Omer 328).*

5 is reported in some annual and phylogenetically advanced species of the tribe. Therefore, the species with $n = 10$ are regarded as diploids. The count for *S. kraschaninnikovii* (n = 9) needs confirmation by further studies since $n = 9$ is uncommon in *Senecio* (hitherto known in only two species).

All members of Anthemideae in the present study have $n = 9$, which is the most frequent and ancestral base number in the tribe (HEYWOOD & HUMPHRIES, 1977). *Achillea millefolium* is known to have four cytotypes, i.e. diploids, tetraploids, hexaploids and octaploids in various parts of its distribution range. However, only diploids are reported from Pakistan and adjacent Indian areas. HUBER-MORATH (1986) distinguished three subspecies in *Achillea millefolium* and according to him, only the subsp. *chitralensis* Hub.-Mor. occurs in our area. This subspecies is differentiated from others by having lesser number of capitula (15-30) per synflorescence. But in our voucher specimen, there are more than 130 capitula in the compact synflorescence. Since the specimen is too young for a critical taxonomic analysis, we have left the subspecies undecided. PODLECH (1986) treated *Tanacetum gracile* Hook. f. & Thoms. as synonymous with *T. fruticulosum* Ledeb. However, in our opinion, *T. gracile* is a distinct taxon that can be distinguished from *T. fruticulosum* by having greater height, somewhat arcuate branches, lax synflorescence with greater number of capitula and smaller size of the individual capitulum. The latter has a wider range of distribution, extending up to Siberia in the north. Therefore, we have tentatively determined our specimen as *T. gracile* until its taxonomic position is decided. Chromosome numbers of two specimens of *T. macropodum* are determined. Of these, the specimen *Omer & Ghafoor 1778* is somewhat different from the typical *T. macropodum* in its habit, size of capitulum and achenes. But at present, we are leaving it under *T. macropodum.*

Cytologically, the tribe Cynareae is probably the most heterogeneous tribe, with gametic numbers forming a complex dysploidal series of 8, 9, 10, 11, 12, 13, 15, 17 and 19 (DITTRICH, 1977) and the information about the ancestral base number of the tribe is not available. We have determined the chromosome numbers of five species and all have a different gametic number. The count for *Saussurea heteromella* ($n = 13$) is contrary to the previous reports (Table 1). A survey of compiled works such as DARLINGTON & WYLIE (1955), ORNDUFF (1967), MOORE (1973), FEDOROV (1974) and GOLDBLATT (1981, 1984) revealed that 13 (or its multiples) is the most frequent gametic number in this genus, whereas $n = 17$ is not known to occur in any other species of the genus. However, this count needs confirmation by analysis of more material in view of this contradiction. The chromosome number of *Zoegia purpurea,* $n = 8$ is reported here for the first time. Chromosome numbers for two other species of this small Central Asian genus are available in literature and both have $n = 14$. Therefore, like other genera of its tribe, this genus also seems to have more than one basic numbers.

Chromosome numbers of ten species of the tribe Lactuceae are determined. TOMB (1977) tentatively regards $x = 9$ as the ancestral base number of the tribe. We found this number in the genera *Sonchus, Lactuca* and *Scariola,* others have lower numbers probably due to descending aneuploidy. The lowest number in the present study is recorded in *Heteroderis stocksiana* ($2n = 6$). This count is the first report for this small Mediterranean genus. *Crepis sancta* is a highly variable species and according to STEWART (1972), subsp. *bifida* (Vis.) Babcock occurs in our area. However, in later works such as LAMOND (1975), the subspecies are merged and only one polymorphic species is recognised. In view of this, we have not mentioned the subspecies. The count for *Sonchus asper* ($n = 8$) is found contrary to the previous reports, however it needs confirmation for there are several reports of $n = 9$ in this species. Tetraploids are recorded in *Scariola orientalis* from various parts of its distribution range (Table 1), but to date only diploids are known to occur in our area and neighbouring Indian territories.

Table 1. Chromosome numbers in Compositae.

S. No.	*Taxon*	*Basic No. x*	*Present count n*	*Voucher*	*n*	*2n*	*Previous counts*	*Level of ploidy*	*Range of distribution*
	Tribe Astereae								
1.	***Erigeron cyanactis* Rech. f. (Fig. 2, A)	9	9	Astore, *Omer 310*	—	—	—	Diploid	N.E. Afghanistan and Chitral (Pakistan)
2.	***E. leptocladus* Rech. f. (Fig. 2, B)		9	Shigar, *Omer 399*	—	—	—	Diploid	E. & N.E. Afghanistan, Chitral & Swat (Pakistan)
3.	***Heteropappus altaicus* (Willd.) Navopokr. var. *decrescens* Grierson (Fig. 2, C)	9	9	Gahkuch, *Omer 294*	—	—	—	Diploid	Afghanistan, Pakistan
4.	***H. holohermaphroditus* Grierson (Fig. 2, D)		9	Skardu, *Omer 362*	—	—	—	Diploid	Pakistan and Kashmir
	***H. holohermaphroditus* Grierson (Fig. 2, E)		9	Quetta, *Omer & Ghafoor 1785*	—	—	—	Diploid	
5.	***Heteropappus* sp. (Fig. 2, F)		9	Quetta, *Omer & Ghafoor 1787*	—	—	—	Diploid	Endemic to Wali-Tangi (Quetta, Pakistan)
	Tribe Inuleae								
6.	**Gnaphalium luteo-album* L. (Fig. 2, G)	7	7	Skardu, *Omer 407*	—	14	Wulff in Darlington & Wylie (1955)	Diploid	Cosmopolitan (temperate areas)
			7	Quetta, *Omer 1225*	7	—	Mehra & al. in Ornduff (1967)	Diploid	
					7	—	Baquar in Moore (1973)	Diploid	
7.	*Gnaphalium americanum* Miller		14	Karachi, *Khatoon & Ghafoor 154A*	14	—	Powell & King in Moore (1973)	Tetraploid	Weed of neotropics, introduced in Pakistan
					14	—	Razaq & al. (unpublished)	Tetraploid	
8.	***Leontopodium jacotianum* Beauverd (Det.: A. J. C. Grierson) (Fig. 2, H)	12	12	Kaghan, *Omer & al. 703*	—	—	—	Diploid	Endemic to Pakistan and Kashmir
	***L.* cf. *jacotianum* Beauverd (Det. A. J. C. Grierson) (Fig. 2, I)	7	14	Astore, *Omer 353*	—	—	—	Tetraploid (?)	
9.	*Pegolettia senegalensis* Cass. (Fig. 2, J)	10	10	Karachi, *Khatoon 150*	—	20	Bhandari & Singhvi in Goldblatt (1981)	Diploid	N. Africa, Arabia, Iran, Pakistan
					10	—	Razaq & al. (unpublished)	Diploid	
10.	*Phagnalon niveum* Edgew. (Det.: M. Qaiser)	9	9	Balakot, *Omer & al. 579*	—	18	Qaiser & Lack (1988)	Diploid	Afghanistan, Pakistan, Kashmir
11.	*Pulicaria boissieri* Hook. f. (Fig. 2, K)	7	7	Kerther Range, *Qaiser & al. 7221*	7	—	Razaq & al. (unpublished)	Diploid	Endemic to Pakistan
12.	**Pulicaria undulata* (L.) C. A. Mey. [Syn. *P. crispa* (Forssk.) Benth. & Hook. f. ex Oliv. & Hiern] (Fig. 2, L)		7	Quetta, *Omer 1247*	—	20	Singh in Darlington & Wylie (1955)	Diploid	N. Africa, Arabia, Iraq, Iran, Afghanistan, Pakistan, India
					—	18	Mehra & al. in Fedorov (1974)		
					—	18	Bir & Sidhu in Goldblatt (1984)		
	Tribe Heliantheae								
13.	*Coreopsis atkinsoniana* Douglas (Fig. 2, M)	12	12	Gahkuch, *Omer 293*	12	—	Parker in Moore (1974)	Diploid	Cultivated in gardens
					12	—	Razaq & al. (unpublished)	Diploid	

** Count new to science — * Count new to flora of Pakistan

Table 1. Chromosome numbers in Compositae.

S. No.	*Taxon*	*Basic No. x*	*Present count n*	*Voucher*	*n*	*2n*	*Previous counts*	*Level of ploidy*	*Range of distribution*
	Tribe Senecioneae								
14.	***Hertia intermedia* (Boiss.) O. Ktze. (Fig. 2, N)	10	10	Gurdgab, *Ghafoor & Yusuf 1358*	—	—	—	Diploid	Iran, Afghanistan, Pakistan
15.	**Senecio desfontanei* Druce [Syn.: *S. coronopifolius* Desf.] (Fig. 2, O)	10	10	Skardu, *Omer & al. 901*	—	20	Brullo & al. in Goldblatt (1984)	Diploid	Pakistan, India, Afghanistan, Westwards to Spain
					20	—	Mehra & Remananden in Moore (1973), in Goldblatt (1981)	Tetraploid	
16.	***S. kraschaninnikovii* Schischkin [Syn.: S. pedunculatus Edgew.]	9?	9	Hunza, *Omer 433*	—	—	—	Diploid	Central Asia, Iran, Afghanistan, Pakistan, India
17.	**S. nudicaulis* Ham. ex D. Don (Det.: A. J. C. Grierson) (Fig. 2, P)		20	Balakot, *Omer & al. 575*	—	40	Mehra & al. in Fedorov (1974)	Tetraploid	Pakistan, eastwards to Sikkim
					—	40	Malla & al. in Goldblatt (1981)	Tetraploid	
	Tribe Anthemideae								
18.	**Achillea millefolium* L.	9	9	Astore, *Omer 314*	—	18	Mehra & al. in Fedorov (1974)	Diploid	Europe, Anatolia, Iran, Afghanistan, Himalayas, Caucasus, Siberia
					—	36	Clausen & al. in Fedorov (1974)	Tetraploid	
					—	54		Hexaploid	
					—	72		Octaploid	
					—	72	Magulaev in Goldblatt (1985)	Octaploid	
19.	***Anthemis rhodocentra* Iranshahr (Fig. 2, Q)	9	9	Quetta, *Ghafoor & Yusuf 1405*	—	—	—	Diploid	Iran, Afghanistan, Pakistan
20.	***Tanacetum gracile* Hook. f. & Thoms. (Fig. 2, R)	9	9	Hunza, *Omer 426*	—	—	—	Diploid	Central Asia, Tibet, Pakistan, India
21.	***T. macropodum* Hemsl. & Lace (Det.: C. J. Humphries) (Fig. 2, S)		9	Quetta, *Ghafoor & Yusuf 1468*	—	—	—	Diploid	Endemic to Baluchistan (Pakistan)
	***T.* cf. *macropodum* Hemsl. & Lace (Fig. 2, T)		9	Quetta, *Omer & Ghafoor 1778*	—	—	—	Diploid	
	Tribe Cynareae								
22.	**Cousinia minuta* Boiss.	10	10	Loralai, *Omer & Ghafoor 1639*	10	—	Mehra & al. in Ornduff (1967)	Diploid	Pakistan, Iran, Afghanistan, India
					—	20	Mehra in Fedorov (1974)	Diploid	
23.	***C. stocksii* C. Winkl. (Det.: A. J. C. Griersen)	12	12	Quetta, *Ghafoor & Yusuf 1315*	—	—	—	Diploid	Iran, Afghanistan, Pakistan
24.	**Outreya carduiformis* Jaub. & Spach	16	16	Ziarat, *Omer & Ghafoor 1434*	16	—	Ghaffari (1986)	Diploid	Iraq, Iran, Afghanistan, Pakistan
25.	**Saussurea heteromalla* (D. Don) Hand.-Mzt.	13?	13	Ziarat, *Omer & Ghafoor 1584*	17	—	Shetty in Moore (1973)	Diploid	S.E. Iran, E. Afghanistan, Pakistan, N.W. Himalayas
					17	—	Koul & al. in Goldblatt (1981)	Diploid	
26.	***Zoegea purpurea* Fresen	8	8	Quetta, *Ghafoor & Yusuf 1306*	—	—	—	Diploid	Iran, Afghanistan, Pakistan, Arabia, Palestine, Egypt

** Count new to science — * Count new to flora of Pakistan

Table 1. Chromosome numbers in Compositae.

S. No.	Taxon	Basic No. x	Present count n	Voucher	n	2n	Previous counts	Level of ploidy	Range of distribution
	Tribe Lactuceae								
27.	**Crepis flexuosa* (DC.) Benth. & Hook. f.	7	7	Skardu, *Omer 409*	—	14	Babcock in Darlington & Wylie (1955)	Diploid	W. Tibet, Pakistan, India
28.	*Crepis sancta* (L.) Babc. (Fig. 2, U & V)	5	5	Astore, *Omer 345;* Ziarat, *Omer & Ghafoor 1419;*	—	10	Babcock & Cameron in Fedorov (1974)	Diploid	S. Europe, S.W. Asia, N.W. Pak.-India subcontinent
				Quetta, *Ghafoor & Yusuf 1239*	5	—	Razaq & al. (unpublished)	Diploid	
29.	***Heteroderis stocksiana* Boiss.	3	2*n* = 6	Quetta, *Ghafoor & Yusuf 1309*	—	—	—	Diploid	Pakistan and Afghanistan
30.	**Lactuca dissecta* D. Don	8	8	Kerther Range, *Malik & al. 2421*	—	16	Mehra & al. in Fedorov (1974)	Diploid	Pakistan, Afghanistan, W. Tibet, Bhutan
					8	—	Shetty in Moore (1973)	Diploid	
31.	**Lactuca tatarica* (L.) C. A. Mey. (Det.: A. J. C. Grierson) (Fig. 2, W)	9	9	Shigar, *Omer 401*	—	18	Whitaker & Jagger in Darlington & Wylie (1955)	Diploid	Balkan, S. Russia, Caucasus, Iran, Afghanistan, Pakistan, C. Asia, N. & W. China
					—	18	Lungeanu in Moore (1974)	Diploid	
					—	16	Kuzmanov & al. in Goldblatt (1984)	?	
32.	**Picris hieracioides* L.	5	5	Hunza, *Omer 425*	—	10	Bergman in Darlington & Wylie (1955)	Diploid	North Asia to Japan, W. Asia, Europe, N. America
					—	10	Mehra & al. in Fedorov (1974)	Diploid	
					—	10	Nazarova in Moore (1973)	Diploid	
					—	10	Fernandez & Queiros in Moore (1973)	Diploid	
					—	10	Löve & Löve in Goldblatt (1985)	Diploid	
33.	**Scariola orientalis* (Boiss.) Soják [Syn.: *Lactuca orientalis* (Boiss.) Boiss.]	9	9	Loralai, *Omer & Ghafoor 1621*	—	18	Murin & Sheikh in Moore (1973)	Diploid	S.W. & Central Asia
					—	36	Babcock & al. in Darlington & Wylie (1955)	Tetraploid	
					18	—	Ghaffari (1986)	Tetraploid	
34.	***Scorzonera divaricata* Turcz. (Det.: A. J. C. Grierson) (Fig. 2, X)	7	7	Astore, *Omer 328*	—	—	—	Diploid	Pakistan, Kashmir, W. Tibet, Mongolia
35.	*Sonchus asper* (L.) Hill		8	Kerther Range, *Malik & al. 2511*	—	18	Stebbins in Darlington & Wylie (1955)	Diploid	Temperate and some tropical regions
					9	—	Baquar & Askari in Moore (1973)	Diploid	
					9	—	Razaq & al. (unpublished)	Diploid	
36.	***S. wightianus* DC. (Det.: A. J. C. Grierson	9	9	Mansehra, *Omer & al. 568*	—	—	—	Diploid	Same as preceding

** Count new to science — * Count new to flora of Pakistan

ACKNOWLEDGEMENTS

We wish to extend our sincere thanks to Dr. M. Qaiser, Mr. Abdul Ghafoor, Mr. Saood Omer, Mr. Rizwan Yusuf and Mr. Kamal Akhter Malik for the collection of material. We are grateful to Dr. A. J. C. Grierson (E) and Dr. C. J. Humphries (BM) for identifying some of the voucher specimens.

REFERENCES

ALI, S. I (1978). The Flora of Pakistan: some general and analytical remarks. *Notes Roy. bot. Gard. Edinburgh* 36: 427-439.

CHOPDE, V. P. (1965). Chromosome numbers in some flowering plants. *Sci. & Culture* 31: 30.

DARLINGTON, C. D. & A. P. WYLIE (1955). *Chromosome Atlas of flowering plants.* George Allen & Unwin Ltd., London.

DITTRICH, M. (1977). Cynareae-systematic review. *In:* HEYWOOD, V. H., J. B. HARBORNE & B. L. TURNER (eds.), *The biology and chemistry of Compositae,* Vol. 2. Academic Press, London & New York.

FEDOROV, A. A. (ed.) (1974). *Chromosome numbers of flowering plants.* Otto Koeltz Science Publishers, W. Germany (reprint ed.).

GHAFFARI, S. M. (1986). In IOPB Chromosome number reports XCIII. *Taxon* 35: 897-903.

GOLDBLATT, P. (ed.) (1981). *Index to plant chromosome numbers for 1975-1978.* Missouri Botanical Garden.

GOLDBLATT, P. (ed.) (1984). *Index to plant chromosome numbers for 1979-1981.* Missouri Botanical Garden.

GOLDBLATT, P. (ed.) (1985). *Index to plant chromosome numbers for 1982-1983.* Missouri Botanical Garden.

GRAU, J. (1977). Astereae-systematic review. *In:* HEYWOOD, V. H., J. B. HARBORNE & B. L. TURNER (eds.), *The biology and chemistry of Compositae.* Vol. 1. Academic Press, London & New York.

HEYWOOD, V. H. & C. J. HUMPHRIES (1977). Anthemideae-systematic review. *In:* HEYWOOD, V. H., J. B. HARBORNE & B. L. TURNER (eds.), *The biology and chemistry of Compositae*. Vol. 2. Academic Press, London & New York.

HUBER-MORATH, A. (1986). The genus Achillea. *In:* RECHINGER, K. H. (ed.), *Flora Iranica,* Contr. No. 158. Graz-Austria.

LAMOND, J. M. (1975). The genus Crepis. *In:* DAVIS, P. H. (ed.), *Flora of Turkey and the East Aegean Islands.* University Press, Edinburgh.

MERXMÜLLER, H., P. LIENS & H. ROESSLER (1977). Inuleae-systematic review. *In:* HEYWOOD, V. H., J. B. HARBORNE & B. L. TURNER (eds.), *The biology and chemistry of Compositae.* Academic Press, London & New York.

MOORE, R. J. (ed.) (1973). Index to plant chromosome numbers for 1967-1971. *Regnum Vegetabile* 90: 1-539.

MOORE, R. J. (ed.) (1974). Index to plant chromosome numbers for 1972. *Regnum Vegetabile* 91: 1-108.

NORDENSTAM, B. (1977). Senecioneae and Liabeae-systematic review. *In:* HEYWOOD, V. H., J. B. HARBORNE & B. L. TURNER (eds.), *The biology and chemistry of Compositae.* Vol. 2. Academic Press, London & New York.

ORNDUFF, R. (ed.) (1967). Index to plant chromosome numbers for 1965. *Regnum Vegetabile* 50: 1-128.

PODLECH, D. (1986). The genus Tanacetum. *In:* RECHINGER, K. H. (ed.), *Flora Iranica,* Contr. No. 158. Graz-Austria.

PODLECH, D. & A. DIETERLE (1969). Chromosomenstudien an afghanischen Pflanzen. *Candollea* 24: 185-243.

QAISER, M. & H. W. LACK (1988). The genus Phagnalon Cass. *Willdenowia* 18: (in press).

SOLBRIG, O. T. (1977). Chromosomal cytology and evolution in the family Compositae. *In:* HEYWOOD, V. H., J. B. HARBORNE & B. L. TURNER (eds.), *The biology and chemistry of Compositae.* Vol. 1. Academic Press, London & New York.

STEWART, R. R. (1972). An annotated catalogue of the vascular plants of West Pakistan and Kashmir. *In:* NASIR, E. & S. I. ALI (eds.), *Flora of Pakistan.* Karachi.

TOMB, A. S. (1977). Lactuceae-systematic review. *In:* HEYWOOD, V. H., J. B. HARBORNE & B. L. TURNER (eds.), *The biology and chemistry of Compositae.* Vol 2. Academic Press, London & New York.

TURNER, B. L. & W. H. LEWIS (1965). Chromosome numbers in the Compositae, IX. African species. *J. S. Afr. Bot.* 31: 207-217.

Address of the authors: Department of Botany, University of Karachi, Karachi-75270, Pakistan.